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DENVER'S MASTER STREET PLAN

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DENVER'S MASTER STREET PLAN

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One of the primary elements of the city plan is an efficient and adequate layout of major streets. The master street plan of Denver is based upon a firm belief in the continued rapid growth of this area, and a concept of land-use guided by a population intent on making Denver a beautiful and inspiring place in which to live. The transportation of people and materials necessarily requires the coordination of the railroads and air transport with the problem of motor vehicles over the highways and streets. These requirements are recognized in the development of the master street plan, which has evolved from almost a hundred years of street construction dating from the earliest days of the community.

Denver, like many population centers of our country, had humble and unpromising beginnings. It was not favored by a fine harbor; river transportation was undependable; the barrier of the Rockies to the west seemed to doom it as an overland transportation route.

No, Denver was founded for other reasons than that of being on a trade route. The area that is now Denver was known during the early days as the Great American Desert, and only adventurous souls in search of gold or fur trading, found their way to this area.

Rumors of gold discoveries by a group of Cherokee Indians aroused interest in the region. Gold seekers from Georgia, headed by W. Green Russell and two brothers, washed gold from the sands of Dry Creek south of Denver in 1858, and the news spread like a prairie fire. Fortune hunters rushed into the region and by the fall of 1858 log cabins dotted areas along the banks of the Platte River. The Russell party purchased from two fur traders questionable ranch claims to a wedge of land above the confluence of the Platte River and Cherry Creek, and proceeded to organize the townsite of "Auraria," then interpreted to mean "Golden Light." The town flourished and permanent buildings, as well as hundreds of log cabins, made their appearance.

Four avenues, now 10th, 11th, 12th and 13th streets, were laid out parallel to the general northwest-southeast course of Cherry Creek, and five cross streets, now Wewatta, Wyncoop, Wazee, Walnut and Larimer, at right angles to the avenues, were surveyed.

Also, in 1858, a party of gold seekers from Kansas, led by General William Larimer, founded a townsite on the east bank of Cherry Creek, opposite Auraria, and quickly expanded their area into a rival community. It was named after General James W. Denver, then Governor of Kansas Territory.

Ox team freighting trains were soon rolling in from the Missouri River towns and New Mexico settlements with supplies and merchandise. They entered the area over a recognized branch of the Santa Fe Trail, moving down Cherry Creek, crossing the hill now occupied by the State Capitol, and continuing along the route now known as 15th Street. This street became the base line for the Denver survey, and streets were laid parallel or at right angles

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to it. These streets did not agree exactly with those of Auraria, and here we have the first monument to uncoordinated planning in which is now the downtown area of Denver.

Across the Platte River opposite Auraria a third settlement of transient gold hunters sprang up. It was called the Town of Highland. The three communities were later merged into Denver City, and became what is now the central business section of the city, bounded in general by Colfax Ave., Zuni St., West Twenty-Sixth Ave, and Broadway. This is the principal area of diagonal streets in Denver.

During Civil War days, Thomas Skerritt, a farmer living a few miles south of Denver, plowed out a primitive road from his home along a newly surveyed half-section line, to Cherry Creek. The road was extended north to meet the diagonal streets of Denver. This street was named Broadway, and it became the baseline for east-west and north-south streets in most of the new annexations to the rapidly growing Denver. Thus, again it appears that accidental circumstances shaped the civic design of the City. In many ways, it is a fortunate factor, inasmuch as the diagonal streets of the central business areas are readily accessible from the outlying districts of the city.

Located in the midst of mineral and agricultural development, favorable climatic conditions for pleasant living, and easy access to a vast trade area where wealth is truly created, Denver has flourished from a few log cabins inspired by specks of gold in Dry Creek, to a metropolitan region of more than 500,000 people. And the problems of traffic within the city have likewise grown.

Another facet to Denver's development has been railroad transportation. The railroads did much to stimulate the growth of the city and they have increased Denver's importance as a distributing center for the Rocky Mountain Region. All six of the rail lines serving Denver converge at a Union Depot; two large marketing centers have been developed, and orderly plans for distribution points are progressing. In spite of the mountain barriers to the west, these main line railroads operate into Denver and serve to make the city a most important link in transcontinental transportation.

The newest form of transportation, the airplane, has found in Denver a favored spot for its operations. Two fine air terminals are located here, and headquarters for some of the major lines of the country are in Denver.

The mass-transportation facilities of Denver also have an interesting history and have had a profound effect upon the growth of the city. The Tramway Company has been in the forefront in matters of city planning and has aided in building an extensive, open city with low population density and in which air and sunlight are everywhere available. The change-over from the noisy streetcars to the rubber-tired electric coaches and gasoline buses was completed after World War II. The new equipment is recognized as an essential element in transporting the population within the area, and it appears to be the planners' best ally in reaching a solution of the intolerable congestion now developing in the central business district. In any event, mass-transportation is an integral part of the traffic problem and is receiving serious consideration in the projection of Denver's Master Street Plan.

The phenomenal increase in motor vehicle use in Denver has imposed demands on the street system beyond their capacity. A commendable presentation of the problem of covering basic needs of an adequate and efficient major street layout integrated with a system of City Parks, connecting boulevards, and provisions for recreational facilities, was published in 1929 by the Denver Planning Commission. Many of the recommendations were put into effect, and

portions of the plan are included in the Valley Highway, the freeway construction now in progress. Also many of the routes in the 1929 plan are included in the Master Street Plan.

The present plan was initiated in 1949 as a cooperative effort by the City, the Colorado State Highway Department and the U. S. Bureau of Public Roads to formulate a master street plan to meet traffic needs over the next twenty years.

The development of the Denver street plan involved several preliminary steps. Based on a general knowledge of the traffic conditions in the city, approximately 215 miles of streets out of the total of 1215 miles, were selected for study. An engineering inventory of the principal characteristics of these streets, the widths of right-of-way, the widths of the traveled portion of the streets, the side improvements such as curbs, traffic control designs and characteristics of adjacent land-use, were determined.

Traffic counts at 418 intersections were secured by the traffic engineering department for study. These counts covered twelve hour periods by half hour intervals. The volume of traffic entering the intersection from each direction was counted and analyzed separately as to its movement within the intersection, i.e. left turn, straight, or right turn. The peak hours were determined, and commercial vehicles were tabulated separately. The State Highway Department used these figures and other counts in the preparation of a traffic volume map covering the city to show conditions in 1949.

Concurrently, an analysis of each signal-controlled intersection was prepared giving data on the signal timing and general regulations relative to the movements of traffic on the various signals. All prevailing traffic and intersection conditions were tabulated for each location and a street capacity study diagram was prepared. Land-use, width of mat, traffic signals, traffic signs and curb cuts are shown on the diagram for each intersection.

Computation showing the relationship between the demand and the practical capacity of the street at each location were made. The traffic volumes were reduced to annual average volumes for a twenty-four hour period and the average daily figures which were used on the city map were reduced to show the thirtieth highest peak hour demand for the year. This figure was utilized for comparison with the practical capacity figure, using the criteria contained in "Traffic Capacity Studies" published by the U. S. Bureau of Public Roads. By this method, the adequacy or deficiency at each of the intersections studied, was determined over the city. A map has been prepared to show this condition graphically.

The next step was to review carefully all items which could be handled by traffic engineering in the interests of economy, using the present facilities. Remedial study sheets were prepared to show the practical design capacity of each intersection approach of the present street and also the present demand. Then, in turn, signal timing improvements, elimination of turning movements, elimination of bus stops, elimination of parking and, finally, prohibition of trucking, were analyzed according to formulae contained in the capacity manual. This analysis also indicated a preliminary determination of street width which would be needed to move the traffic if no remedial traffic control measures were taken and, secondly, the width if all remedial traffic control measures were taken.

Thus far, we had arrived at the needs for present traffic and street capacities. It was then necessary to make a projection of estimated traffic volumes to 1970.

Expansion factors based on national trends in general use were supplied by

the Bureau of Public Roads as follows:—

1.	Inter-regional system	2.2
2.	Main Highways	1.85
3.	Other State Highways	1.65

The logic of using national indices was questioned, due to the differences between local and national trends. When this question was posed to representatives of the Bureau of Public Roads and the State Highway Planning Survey, they recommended that a local study be made. In order to minimize annexation and other similar factors, it was decided to use the metropolitan area data according to the Federal definition of the Denver Metropolitan Area, to include Denver and the surrounding counties of Adams, Arapahoe and Jefferson..

The present traffic volume was determined to be 2,020 million vehicle miles, and the traffic volume for 1970 was estimated to be 5,458 million vehicle-miles. The ratio of the future traffic to present volumes indicates a factor of 2.7, and indicates the estimated extent to which all travel on all streets in the metropolitan area would increase. This uniform expansion factor represents the overall growth of all traffic traveling on all present and future streets in the metropolitan area.

However, land is not developed equally in all parts of the metropolitan area and traffic could not be expected to do so. As a result, 1970 traffic for specific routes was computed on the basis of land-use trends instead.

Two types of traffic are commonly called induced traffic. The term "generation induced traffic" is used to refer to traffic which is generated as a result of increased land-use in the areas served by each specific street. The term "design induced traffic" is used to refer to traffic which is induced to use one street in preference to another on the basis of the street conditions and construction.

The generation induced traffic is a reflection of land-use patterns. The factor which reflects only increased vehicle ownership and use, and which eliminates the influence of population by holding the population constant, was determined to be 1.60 (expansion without population increase). This factor was applied to all traffic.

"The Denver Metropolitan Area Origin and Destination Study for 1945" was used to determine the generation induced traffic volume and a projection of this study to assumed conditions in 1970 was made. Anticipated future patterns of land development and the number of vehicular trips per dwelling unit per day were estimated, considering changes which could be expected in land use in the metropolitan area by census tracts, low, medium and high income classes of residents in each tract, parking facilities in central business districts, and the purpose of the trips.

Desire line patterns for traffic in 1970 were established on a series of approximately 40 maps, using one map for each destination. Generated traffic was mapped as a straight line varying in width according to volume from each origin to each destination. Thus, the origin-destination pattern for generated traffic was established. Using these maps as a guide and considering the requirements of the highways entering the city from the surrounding counties, a selection of traffic ways within the city was made.

In arriving at this urban selection, three basic types of traffic movements were considered, e.g. inter-regional traffic originating in or destined for areas beyond the region, intra-regional traffic moving from one principal area to another within the region, and local traffic moving from a principal

artery to ultimate destination within one area of the region. The corresponding street types to meet these needs were designated—

1) Primary streets for inter-regional traffic.
2) Secondary streets for intra-regional traffic.
3) Major streets for distribution of traffic from the primary and secondary streets.

Obviously, any given street can carry more than one type of traffic and, in the case of Denver, a considerably higher percentage of the trips were found to originate and terminate within the city than the trips which originate or terminate outside. A percentage of trips originating or terminating outside of the region was estimated on the basis of counts made by the State Highway Department in 1940 and supplemented with spot counts in succeeding years.

The tentative urban street system is based on the above assumptions, together with the combined thinking of engineers and planners in the area who have been working on the problem for some time. This general knowledge was submitted with the analysis of land-use outlined in the foregoing, and as the transfer and assignment of traffic progressed, the need for certain additional routes became clearer. These routes were added to the urban street system.

Designation of an urban street system is an individualized process for each community and is probably not susceptible to standardized rules, although the use of radial streets for direct access from residential area to the central business district and of the ring systems of streets are fairly standard theory. It should be noted in this regard, however, that patterns of cities differ and the principal criterion for the location of the routes of urban streets should be where the people are and where they want to go or, in other words, the use of a present and anticipated future desire pattern on an origin and destination basis.

At this point in the development of the plan, it is desirable to emphasize that there is a difference between street design and right-of-way selection. The design of the street is a function of the anticipated volume of traffic. The choice of right-of-way is a matter of combined engineering and economics to secure the greatest service to the largest number of our people. Until right-of-way studies can be completed, the street may be designated by a route name, such as the North-South Midtown or the East-West Crosstown and located by area, such as "having a route located between 12th Avenue and 18th Avenue."

A principal objective of the Street Plan is to provide adequate facilities for anticipated traffic, and in some cases this can most economically be done by consolidating traffic from several heavily traveled streets in close proximity to each other onto one limited access thoroughfare which will serve the traffic now carried by all of them, together with the future increase.

The Master Street Plan for Denver represents a fairly small street mileage of the city. The system covers approximately 166 miles out of an estimated total of 1215 miles of streets and represents the traffic ways required to meet estimated conditions in 1970. Approximately 39 miles of the proposed plan are considered as freeways. About 36 miles would classify as expressways and the balance of 91 miles would be major streets, including 57 miles of one-way street facilities with progressive traffic signal control. The total overall estimated cost of the plan based on 1951 costs is $154,000,000. Forty per cent of this figure represents estimated right-of-way costs.

One freeway, the Valley Highway, is now under construction and represents

the first major effort since World War II to provide a modern cross-town artery to meet Denver's traffic needs. This limited access facility will be 10.4 miles long, extending from the north city limits of Denver southerly and southeasterly through the city. At present 3.8 miles have been constructed or are under construction, the total estimated approximate cost being $6,000,000 including right-of-way expense, or an overall estimated cost of $1,580,000 per mile. The project is being constructed by the Colorado State Highway Department using Federal Aid Urban Funds, as well as State and City money.

When completed it is anticipated that the Valley Highway will do much to set the pattern for additional limited access routes within the city. Also, the entrance and exit points on this highway will make it imperative that connecting major streets within the city be developed quickly to avoid confusion and inadequate conditions approaching the Valley Highway. For instance, the 46th Avenue interchange connects with the present overloaded streets both east and west of the freeway. The development of this East-West route across North Denver will not only relieve congestion of internal traffic, but also will meet the State Highway routes which provide relief for east-west regional traffic and furnish an alternate artery east-west from Denver.

The viaducts connecting North Denver with the central business section are feeling the impact of the Valley Highway traffic, and peak hour traffic loads become more serious. The junction of Valley Highway with South Colorado Boulevard near south limits of Denver, will soon result in an added traffic demand on the already overloaded north-south street. Our interim plan includes widening Colorado Boulevard north from the Valley Highway. This construction would alleviate congestion for the next several years and should be done in any event. However, the traffic estimated for 1970 would require a freeway facility which is included in the Master Plan.

An expressway type trafficway is planned from the Municipal Airport to the central section of the City. This development is considered essential to complete adequate access to air transport into Denver.

These are a few of the principal immediate traffic needs for Denver as included in the Master Street Plan. However, such a plan is not assembled on the basis that it is inflexible and cannot be changed, but it is a static structure. As time passes, new concepts appear; unexpected traffic trends develop; traffic habits change due to new enterprises or entertainment facilities, and housing developments make a shift in direction. Such conditions as these make it necessary to review the plan frequently, to revise traffic estimates as new traffic counts and inventories are made available, and to modify details to fit the new horizons of traffic twenty years in the future.